Predicting the fate of pharmaceuticals during wastewater treatment and crop irrigation with reclaimed wastewater

González-García, Mariano; Fernández-López (, Carmen; Polesel, Fabio; Trapp, Stefan

Published in:
SETAC Europe 28th Annual Meeting - Abstract book

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Predicting the fate of pharmaceuticals during wastewater treatment and crop irrigation with reclaimed wastewater

Mariano González García[1], Carmen Fernández-López[1], Fabio Polesel [2], Stefan Trapp[2]

[1] Catholic University of Murcia (UCAM), Murcia, Spain.

[2] DTU Environment, Technical University of Denmark, Bygningstorvet 115, Kgs. Lyngby, Denmark

Wastewater represents an alternative option for use in urban areas, industry and, especially, agriculture. In this context, pharmaceuticals may undergo incomplete elimination in wastewater treatment plants (WWTPs) and are found in reclaimed wastewater, possibly being uptaken in crops following wastewater irrigation. Among commonly consumed crops, vegetable production uses considerable amounts of reclaimed wastewater for irrigation.

In this study, we investigated the fate of pharmaceuticals compounds in a wastewater treatment plant (WWTP) equipped for the elimination of carbon and nutrients. The primary treatment consists of a screen, an aerated bean extraction tank and a primary clarifier. The biologically treated wastewater from the conventional activated sludge is filtered through a layer of a continuously operating sand filter prior to being disinfected by ultraviolet radiation. Effluents are used for irrigation in agriculture. We used the simulation tool “Activity SimpleTreat - fate model for ionics in wastewater treatment plants” [1] to predict the fate of pharmaceuticals compounds in the municipal WWTP. Model parameters were adapted to the situation at site. Chemical data were estimated using ACD/i-Lab. Model predictions were verified with measurements from a monitoring campaign in the WWTP. Results showed a high measured removal efficiency of Diclofenac, Ibuprofen and Ketoprofen concentrations in the WWTP and the simulation tool confirmed the same conclusion.

As to uptake in lettuce, empirical results were compared to simulation outcome. For plant uptake prediction, a new steady-state model with translocation and phloem flow was applied [2]. Addition of phloem transport was necessary because the investigated compounds include weak acids (pKa 4 to 5), such as ibuprofen and naproxen, which undergo ion trapping in the alkaline phloem fluid (pH 8). The preliminary results with the new steady-state model, showed the uptake capacity of pharmaceuticals in different

tissues of lettuce. The assimilation and distribution of pharmaceuticals compounds in the edible part of the lettuce leaves and the subsequent passage to the harvested plant parts is investigated.

[1] Franco A. 2011. Activity SimpleTreat - fate model for ionics in wastewater treatment plants. homepage.env.dtu.dk/stt/Homepage%20anf/Website.htm

[2] Trapp S. 2017. New release dynamic (numeric) coupled soil-plant uptake model for monovalent ionics, homepage.env.dtu.dk/stt/2017Release_Plant_Model/index.htm

Keywords: Pharmaceutical compounds; wastewater; plant uptake; fate prediction, vegetables.

Session: 3.7

Presentation preference: poster presentation